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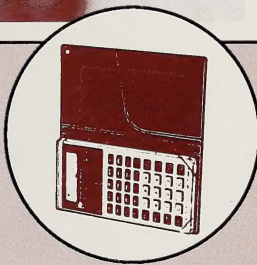


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COURSE INTRODUCTION
and
PROBLEM SOLVING

MODULE 1

LEARNING FACILITATOR'S MANUAL



MATHEMATICS 7

Distance
Learning



Alberta
EDUCATION

JUL 5

1991

Mathematics 7

Course Introduction and Module 1

LEARNING FACILITATOR'S MANUAL

Note

This Mathematics Learning Facilitator's Manual contains answers to teacher-assessed assignments and the final test; therefore, it should be kept secure by the teacher. Students should not have access to these assignments or the final tests until they are assigned in a supervised situation. The answers should be stored securely by the teacher at all times.

Mathematics 7
Learning Facilitator's Manual
Module 1
Problem Solving
Alberta Distance Learning Centre
ISBN No. 0-7741-0102-4

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COURSE INTRODUCTION



Overview of the Learning Package

A survey of these course materials will confirm that this new learning package has been specially designed for many kinds of teachers working in a variety of situations.



Small-Schools Teacher

-  inexperienced
-  experienced, but in other subject areas
-  experienced in teaching mathematics studies, but wanting to try a different approach

Distance-Learning Teacher

-  travelling to schools within the jurisdiction
-  using facsimile and teleconferencing to teach students within the area

Larger-Schools Teacher

-  inexperienced
-  experienced in teaching mathematics studies, but wanting to try a different approach

Because this learning package has been created by experienced classroom teachers and distance learning specialists, it has many advantages for students and teachers regardless of their situation.

Here are some advantages for students:

- incorporates a strong learner-centered philosophy
- promotes such qualities in the learner as autonomy, independence, flexibility
- is developed through media which suits the needs and circumstances of the learner
- reflects the experiential background of Alberta students
- opens up opportunities by overcoming barriers that result from geographical location
- promotes individualized learning, allowing learners to work at their own pace

Here are some advantages for teachers:

- allows teachers maximum teaching time and minimizes preparation time
- includes different routes through the materials to suit different learners
- incorporates a wide range of teaching strategies, in particular those using independent and individual learning
- delivers curriculum designed by education specialists that reflects Alberta Education Program of Studies with an emphasis on Canadian content
- provides learning materials which are upwardly compatible with advanced educational technology

As you preview this Learning Facilitator's Manual (LFM) and the accompanying student materials, you will discover that this learning package is very extensive. That is because we do not want to short-change anyone.

The student materials have many helpful features.

- Module 1 introduces problem solving, and this skill is emphasized throughout the package.
- Modules 2-7 contain pretests to help you determine the student's strengths and weaknesses in each strand.
- Background material is included for students who have not mastered previously developed skills, so they can make a smooth transition.
- New skills are developed carefully and fully, and there is an abundance of practice.
- Horizontal enrichment (games, math trivia, calculator activities and computer activities) are included to make mathematics fun and interesting.

The Learning Facilitator's Manual (LFM), also has many helpful features.

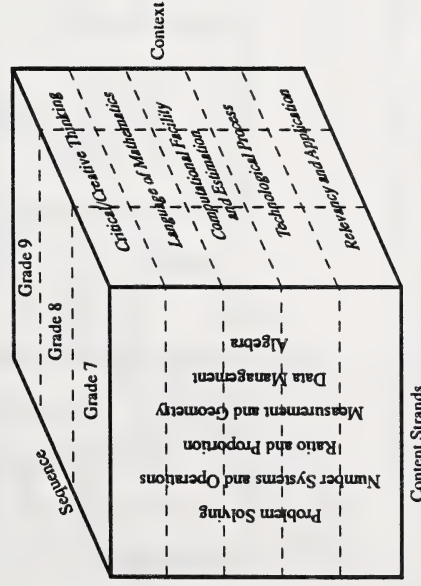
- This introduction contains an overview of the current Alberta Education Program of Studies for junior high mathematics. This overview is included for inexperienced teachers or those teachers who have found themselves teaching junior high mathematics when their training is in other subject areas. This brief summary is not meant to replace the Alberta Education Program of Studies, but rather to help you confirm the highlights of the program.
- Other parts of this introduction will help you become familiar with this new courseware and how you might want to use it in your classroom.
- Beyond the introduction, the Learning Facilitator's Manual contains answers, models, explanations, and other tips generated by the teachers who authored this course.

This learning package is the product of experienced classroom teachers and distance learning specialists. It is the hope of these teachers that their experience can be shared with those who want to take advantage of it.

Overview of the Junior High Mathematics Program of Studies

The dimensions of the Junior High Mathematics Program can be summarized by the following diagram:

Junior High Mathematics Program Dimensions

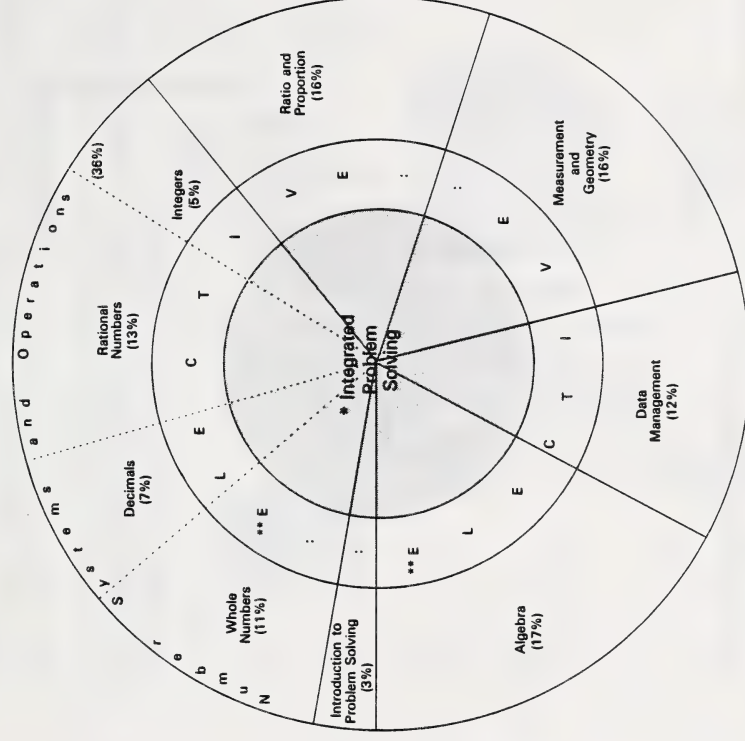


The Junior High Mathematics Program has two components: the required component and the elective component. Eighty percent of the student's time shall be spent on the basic skills, knowledge, and attitudes outlined above. Twenty percent of the student's time shall be spent on activities meeting individual needs (remedial and/or enrichment). The enrichment shall be horizontal and not vertical; it is not intended to provide acceleration.

^{1,2}Alberta Education for excerpts from Junior High Mathematics Program of Studies.

The minimum requirement for the program is 100 hours.

Suggested Time Allocations



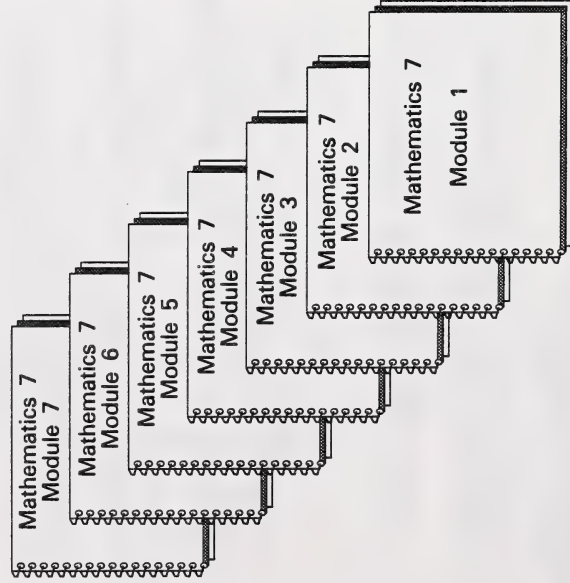
* Integrated Problem Solving - 20% of time
** Integrated Elective (meeting individual needs) - 20% of time

Course Components

This learning package involves many other components in addition to this Learning Facilitator's Manual:

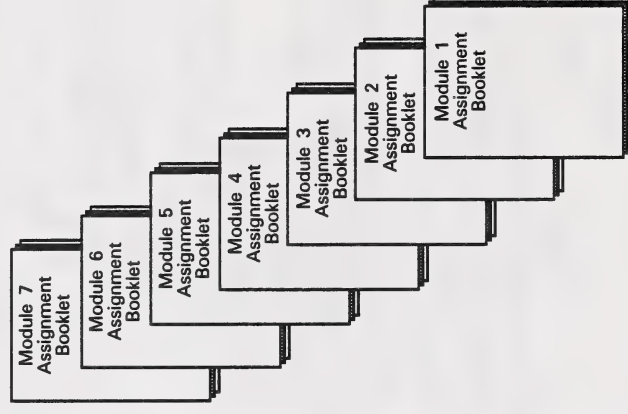
Module Booklets

The print components include seven Module Booklets, one for each module. These Module Booklets contain guided activities that instruct the students in a relevant, realistic setting.



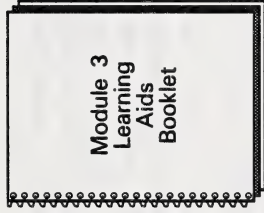
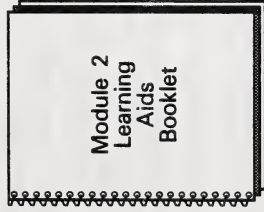
Assignment Booklets

There are seven Assignment Booklets, one for each module. The activities in these booklets can be used for formative and summative assessments.



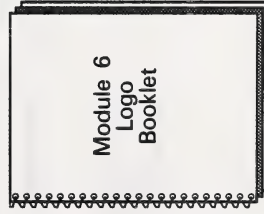
Learning Aids Booklets

There are two Learning Aids Booklets for use with Modules 2 and 3. These booklets guide the student through concrete experiences with whole numbers, integers, fractions, and decimals.



Logo Booklet

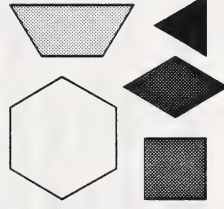
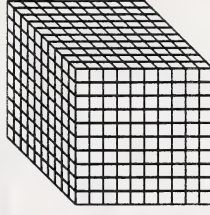
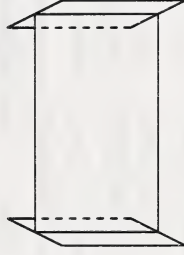
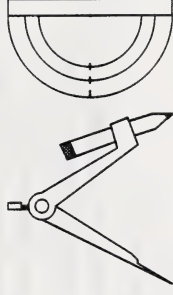
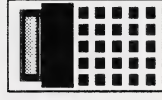
There is one Logo Booklet. It guides the student through a variety of geometric activities at the computer.



Learning Aids and Equipment

Students require the use of a calculator, geometry set, two-coloured counters, dice, and various manipulatives: base 10 blocks, pattern blocks, and a MIRA. These manipulatives are available from the Learning Resources Distributing Centre.

In addition it is recommended that students have access to a two-pan balance scale, a metric stick, calibrated beakers, and metric measuring cups and spoons.



Media



Computer Disk



Videocassette

Course Audiocassette Providing
General Teacher Guidance

The package also includes media options. Pathways have been developed so students can use computer disks and videocassettes to achieve the objective. These different routes have been included to suit different learners. Wherever videos or computer software have been included, a print pathway is also available. This way, if the media isn't available or desired, a student can follow the print pathway and still successfully achieve the objective.

A special audiocassette features a teacher guiding the student through the course. The appearance of the teacher icon reminds students that there is this additional help available. If the students are working individually, you may find this audiocassette a valuable asset. If the students are working in a large group, you may wish to guide the students yourself.

A list of the video and computer programs cited in the course follows.

Video Programs

THINK ABOUT: Find Your Guide (AIT)

THINK ABOUT: There Are Many Ways to Go (AIT)

THINK ABOUT: Using Estimating and Approximating (AIT)

MATHWORKS: Identifying the Problem (AIT)

MATHWORKS: Simplifying a Problem (AIT)

MATHWORKS: Place Value of Large Numbers (AIT)

MATHWORKS: Using Mental Computation for Addition (AIT)

MATHWORKS: Using Mental Computation for Subtraction (AIT)

MATHWORKS: Relating Decimals and Fractions (AIT)

MATHWORKS: Analyzing Data (AIT)

SOLVE IT: Reasonableness of Answers (AIT)

SOLVE IT: Guess-Check-Revise (AIT)

SOLVE IT: Solving a Simpler Problem (AIT)

SOLVE IT: Using Mental Computation for Multiplication (AIT)

SOLVE IT: Estimation Strategies for Multiplication (AIT)

SOLVE IT: Estimation Strategies for Division (AIT)

SOLVE IT: Ordering Decimals (AIT)

SOLVE IT: Precision and Estimation (AIT)

SOLVE IT: Measuring Volume (AIT)

SOLVE IT: Measuring Angles (AIT)

MATHWISE: Locating and Interpreting Graphs (AIT)

Video programs used in this course may be available from your regional media centre, or from ACCESS Network.

Computer Programs

Conquering Whole Numbers (MECC)

Growgins' Fractions (MECC)

Problem-Solving Strategies (MECC)

Number Munchers (MECC)

Mathematics Activities Courseware 6 — MAC 6 (Houghton Mifflin)

Mathematics Activities Courseware 6 — MAC 7 (Houghton Mifflin)

Mathematics Activities Courseware 6 — MAC 8 (Houghton Mifflin)

Computer Drill and Instruction: Mathematics, Level D (SRA)

Math Strategies: Problem Solving (SRA)

Fraction Factory (Springboard Software)

Logo (Apple)

Mathematics for Science: Measurement (Merlan Scientific)

Integer Fast Facts (Edusoft)

Geo Pool and Geo Billiards (CAE Software Inc.)

Computer programs used in this course may be available from your regional media centre, the Learning Resources Distributing Centre, ACCESS Network, or a computer software supplier (see "computer supplies" in the Yellow Pages of your telephone book).

Computer-Managed Learning

The Learning Management System™ (LMS) is available for this course. To access LMS you require a Digital Equipment Corporation (DEC) VAX™ computer system. Further information may be obtained from the

Alberta Distance Learning Centre
Box 4000
Barrhead, Alberta
T0G 2P0

Telephone 674-5333

Design of the Learning Package

Course Rationale and Philosophy

This learning package was designed and developed using these assumptions:

- It is important to enhance a student's ability to solve problems.
- In learning new concepts students need to progress in stages from concrete, through pictorial, to symbolic.
- Students have varying learning styles and abilities which must be recognized.
- Calculators and computers are tools with which students must become familiar in order to function effectively in this technological age.
- Students need opportunities to practise new skills and to maintain previously developed skills.
- The progress students make in meeting mathematics objectives should be evaluated using both formal and informal methods.

Course Goals

The goals of this learning package are to enable students to do the following:

- to grow in their capability to solve problems
- to use mathematics as a tool in the pursuit of personal goals and aspirations
- to develop good self-concepts and positive attitudes towards mathematics and lifelong learning

Design

The learning package has been specially designed to promote such qualities in the learner as autonomy, independence, and flexibility. Writers have incorporated the teaching strategies of working from the concrete to the abstract, linking the old to the new, getting students actively involved, using advanced, intermediate, and post organizers, and many other techniques to enable learners to learn on their own for at least some of the time.

The modules in Mathematics 7 follow a systematic design.

Each module booklet begins with a table of contents and a module introduction.

Contents at a Glance
Module Introduction

The module booklet is then broken into sections. The number of sections will vary from module to module, but each section has the same design:

- The skills and words to be learned are listed under the heading "What Lies Ahead."

Section 1
Skills/Words to be Learned
Introduction
Learning Activities

- There is an informal introduction to help motivate the student and explain the nature of the section.

Section 2
Skills/Words to be Learned
Introduction
Learning Activities

- There is a sequence of activities to learn and to practise the skills and words cited.

Section 3
Skills/Words to be Learned
Introduction
Learning Activities

A module conclusion directs the student to the Module Assignment in the Assignment Booklet.

Module Conclusion
Module Assignment

The module booklet usually ends with an appendix that contains a glossary and pull-out sheets.

Appendix
Glossary
Pull-Out Sheets

Most sections have a wide variety of activities:

- **Listening and Reading Activities** guide the student through the development of various concepts. The reading passages use worked examples and are written at a suitable reading level.
- **Video Activities** give the student opportunities to see and hear mathematical concepts discussed.
- **Introductory Activities and Learning Aids Activities** prepare the student for the section. The Learning Aids Activities use learning aids (manipulatives) so that the student has concrete experiences.
- **Practice Activities** give the student practice doing routine questions similar to those in the examples.
- **Extra Practice Activities** give the student who has experienced difficulty with the Practice Activities extra practice. Often a computer drill and instruction is included as an option.
- **Concluding Activities** give the student non-routine problems, computer games, and other enrichment activities.

Note

Students are **not** expected to do all the activities in the module booklet. You will help the student decide which activities are appropriate for his or her level of understanding and learning style preferences.

Using this Learning Package in the Classroom

Conventional Classroom

Whether your classroom has desks in rows, or tables in small groups, you may be most comfortable with a learning system that you can use with all your students in a paced style. In other words, you may want a package that will suit all of your students so they can move through the materials as one group or several small groups. Because these materials contain different routes or pathways within each unit, they can address various learning styles and preferences. The materials also include many choices within the activities to cater to different thinking levels and ability levels. Because of their versatility and flexibility, these materials can easily suit a conventional classroom.

Open-Learning Classroom

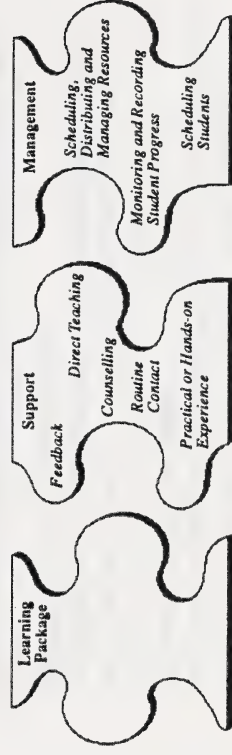
Open-learning is the concept of opening up opportunities by overcoming barriers of time, pace, and place by giving the learners a package specially designed to enable them to learn on their own for at least some of the time.

Such a concept is not new. Many teachers can recite attempts to establish an individualized learning system as they recognized the importance of trying to personalize coursework to meet each individual student's needs. But these efforts often failed, due to lack of time and lack of quality materials that conformed to Alberta specifications.

Due to advanced educational technology and improved Alberta-specific learning packages, a student-centered approach is now possible. Improved technology now allows us to provide support to learners, individually, regardless of their pace or location. A teacher cannot be in 28 places at one time offering guidance — media and a well-designed learning package can satisfy individual needs. Technology can also help provide an effective management system needed to track the students as they progress independently through the materials.

The key to a successful open-learning system depends on three vital elements: a learning package specially designed to enable students to learn effectively on their own, for at least some of the time; various kinds of learner support; and a management system and style that ensures that the open-learning system runs smoothly.

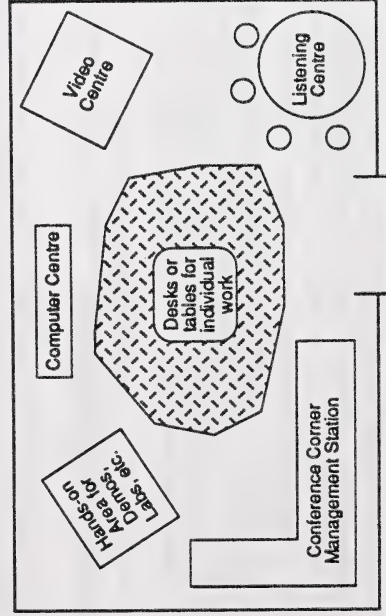
The Key to a Successful Open-Learning System



Learning Package

The specially-designed learning package needed for a successful open-learning system has been developed for you. The objectives teach current Alberta specifications using strategies designed for individualized instruction. As the learning facilitator, you need to be sure to have all the components in the learning package available to students as needed.

If adequate numbers of media are available to satisfy the demand, a centre can be established for specific media:



You may not have the luxury to have enough hardware to set up a permanent video or computer center in your classroom. In that case, students should be encouraged to plan ahead. Perhaps every 3 - 5 days they should preview their materials and project when they would need a certain piece of media. This would allow you to group students, if necessary, or reserve media as required.

Support

Support is definitely a key element for any successful learning, and when you're planning an individualized, non-paced program, you need to carefully plan when and how support will be given.

The materials contain a form of consistent support by providing immediate feedback for each of the activities included in the module booklet.

The answers, explanations, and examples for each of the module activities are included in this *LFM*. You may decide to set up an answer station with colour-coded cards or you may want the students to come to you to discuss the activity together. As you and the students become more comfortable with an individualized system, you might increase the student's responsibilities — spot checking only to reinforce proper behaviour and to assess the student's day-to-day progress.

As the learning facilitator, you may be needed to offer more personal guidance to those students having difficulty, or you may need to reinforce the need for doing these activities carefully before attempting the assignments in the Assignment Booklet.

The activities include choices and pathways. If a student is having difficulty, you may need to encourage that student to work on all the choices rather than one. This would provide additional instruction and practice in a variety of ways.

Another form of support is routine contact with each individual. This might be achieved with a bi-weekly conference scheduled by you, or as students reach a certain point (e.g. after each section is completed), they may be directed to come to the conference area.

Special counselling may be needed to help students through difficult stages. Praise and encouragement are important motivators, particularly for those students who are not used to working independently.

Direct teaching may be needed and scheduled at certain points in the program. This might involve small groups or a large group. It might be used to take advantage of something timely (e.g. election, eclipse, etc.), or something prescheduled like the demonstration of a process, or involving students in a hands-on, practical experience.

Support at a distance might include tutoring by phone, teleconferencing, or planned visits. These contacts are the lifeline between learners and distance education teachers, so a warm dialogue is essential.

Management

Good management of an open-learning system is essential to the success of the program. The following areas need action to ensure that the system runs smoothly:

- Scheduling, Distributing and Managing Resources — As discussed earlier, this may require a need for centres or a system for students to project and reserve the necessary resources.

- Scheduling Students — Students and teachers should work together to establish goals, course completion timelines, and daily timelines. Although students may push to continue for long periods of time (e.g. all morning), teachers should discourage this. Concentration, retention, and motivation is improved by taking scheduled breaks.

- Monitoring Student Progress — You will need to record when modules are completed by each student. Your data might also include the projected date of completion if you are using a student contract approach.

Sample of a Student Progress Chart

Mathematics 7	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7	Final Mark
Billy Adams	P							
	A							
Sandy Nepoose	P							
	A							
Joe Bloom	P							
	A							
P = Projected Completion Date A = Actual Completion Date								

The student could keep a personal log as well.

Such tracking of data could be stored easily on a computer.

- Recording Student Assessments — You will need to record the marks awarded to each student for work completed in each module Assignment Booklet. The marks from these assignment booklets will contribute to a portion of the student's final mark. Other criteria may also be added (a special project, effort, attitude, etc.). Whatever the criteria is, it should be made clear to all students at the beginning.

Sample of a Student's Assessment Chart

Mathematics 7	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7	Final Test	Final Mark
Billy Adams	67	65	54	47	78	67	63	63	63
Sandy Nepoose	43	50	54	55	48	42	49	52	50
Joe Bloom	65	65	66	68	67	70	67	65	66

Letter grading could easily be substituted.

- Recording Effectiveness of System — Keep ongoing records of how the system is working. This will help you in future planning.

Sample of a System Assessment Chart

Module 1			
Date	Module Booklet	Assignment Booklet	Resources-Media

The Roles of the Teacher and the Student in an Open-Learning Classroom

The teachers in a conventional classroom spend a lot of time talking to large groups of learners. The situation in open learning requires a different emphasis. Teachers will probably meet learners individually or in very small groups.

With this approach it is necessary to move beyond the idea of a passive learner depending largely on the continually supportive teacher. The teacher must aim to build the student's confidence, to stimulate the learner into self-reliance, and to guide the learner to take advantage of routes that are most meaningful and applicable to the learner.

These materials are student-centered not teacher-centered. The teacher needs to facilitate learning by providing general support to the learner.

Evaluation

Evaluation is important to the development of every learner. Data gathering, processing, and decision making, both at the student and teacher level, serve as means of identifying strengths and weaknesses.

These specially-designed learning packages contain many kinds of informal and formal evaluation: observation, individualized conferences, self-appraisal, informal evaluation, assignments, and final tests.

Many of the activities include choices for students. If the student is having difficulty, more practice may be warranted, and the student may need to be encouraged to do more of the choices. If the student has access to a video player or a computer, media options are available. If not, print options must be chosen. Students are expected to be involved in the decision as to which pathway best suits their needs. They may decide to do both.

Self-appraisal techniques can also be introduced at the individual conferences. Such questions as the following might be included:

- What steps are you taking to improve your understanding of this topic?
- What method of study do you use most?
- How do you organize your material to remember it?
- What steps do you follow when doing an assignment in your assignment booklet?
- What could you do to become an even better reader?
- Do you have trouble following directions?
- Did you enjoy this module?

A chart or checklist could be used for recording responses.

Informal Evaluation: Assignments

Informal evaluation such as the assignments included in each module, are an invaluable aid to the teacher. They offer ongoing assessment information about the student's achievement and the behaviour and attitudes that affect that achievement.

Each module contains a separate booklet called the Assignment Booklet. This booklet assesses the knowledge or skills that the student has gained from the module. **The student's mark for the module may be based solely on the outcome of learning evident in the Assignment Booklet; however, you may decide to establish a value for other variables such as attitude or effort.** It is important that you establish at the beginning which outcomes will be evaluated, and that all students clearly understand what is expected.

Final Test

Each LFM includes a formal final test which can be photocopied for each member of the class. The test, closely linked to the learning outcomes stated in the module booklets, gives the teacher precise information concerning what each student can or cannot do. Answers, explanations, and marking guides are also included.

The value of the final test and each module is the decision of the classroom teacher. Following is a suggestion only.

Module 1 10%	Module 2 10%	Module 3 10%	Module 4 10%
Module 5 10%	Module 6 10%	Module 7 10%	Final Test 30%

Introducing Students to the System

Your initiation to these learning materials began with a basic survey of what was included and how the components varied. This same process should be used with the class. After the materials have been explored, a discussion might include what the advantages and the disadvantages might be of learning independently or in small groups. The roles of the students and teacher should be analyzed. The necessary progress checks and rules need to be addressed. Your introduction should motivate students and build a responsible attitude toward learning autonomously.

Reading Level

These course materials are largely print-based, but poorer readers need not be discouraged. It is important that you assure the students that these materials have been designed for easy reading. The authors have employed special strategies that lower and control the reading level. Some of them are

- the conscious selection of vocabulary and careful structuring of sentences to keep the materials at an independent reading level
- the integration of activities, examples, and illustrations to break text into appropriate-sized chunks
- the inclusion of many kinds of organizers (advance, graphic, intermediate, concept mapping, post-organizers) to help give students a structure for incorporating new concepts

- the recognition that vocabulary and concepts are basic to understanding content materials, and thus must be handled systematically (defined in context and in a specialized glossary)
- the acknowledgement that background knowledge and experience plays a vital role in comprehension
- the systematic inclusion of illustrations and optional videos to help poorer readers and visual learners, and audiocassettes and software also as an alternative to print-based learning
- a variety of formats (paragraphs, lists, charts, etc.) to help poorer readers who do not absorb or retain main ideas easily in paragraph format
- the inclusion of media pathways and activity choices to encourage an active rather than passive approach
- instruction in a meaningful setting rather than in a contrived, workbook style
- using purposeful reading, viewing, and doing to produce better interpretation of the course materials
- the recognition that students need structured experiences when reading, viewing, or listening to instructional materials: developing pupil readiness, determining the purpose, providing guided instruction and feedback, rereading if necessary and extending. This structure closely resembles the reading process.

Study Skills

It is important for students to understand that there are certain study skills that they will need in order to be independent learners and to deal successfully with the course materials. They are listed below.

- understanding and using instructional materials (table of contents, glossary)
- reading at a flexible rate
- remembering facts
- goal setting and practising for success
- using reliable study methods

To decide the level and amount of instruction needed to accommodate the varied levels among students, you may wish to interview students or to prepare and administer skill inventories or pretests. If most students need help with a particular skill, you may want to set up a temporary study group to help students who need it.

The following videos may be helpful.

THINKABOUT: You Can Remember (AIT)

THINKABOUT: Practice for Success (AIT)

THINKABOUT: Calm Your Jitters (AIT)

THINKABOUT: Get Ahead With Goals (AIT)

THINKABOUT: Make a Deal with Yourself (AIT)

THINKABOUT: There Are Ways to Remember (AIT)

Video programs may be available from your regional media centre, or from Access Network.

Sequencing

It is recommended that you start with Module 1 because this module includes basic introductory information. It is further recommended that you complete the modules in order because each module requires skills introduced in previous modules.



These materials are very comprehensive. It is important that you assure the students that the learning package is designed to build on what the student already knows.

Students are not expected to do all the activities. Explain that you will help each student decide which activities are appropriate to his or her level of understanding and learning style preferences.

There are built-in pretests in Modules 2-7. These will help you and the student to recognize his or her strengths and weaknesses and to individualize the program. If the student already has a good understanding of the concepts to be taught or reviewed in a section, most of the section can be omitted. (We encourage the student to skim the section and do the concluding activity, however.) If the student's knowledge of the concept to be taught or reviewed is weak, all the necessary information is provided. (The student is encouraged to work through the entire section carefully.) There are also opportunities for the students to get additional reinforcement of difficult concepts if this is required.

These materials attempt to make mathematics real and fun. Every attempt has been made to give students a variety of meaningful activities and to give the students a chance to know when they have achieved mastery.

These materials also have integrated videos, computer software, and learning aids to add variety and cater to learning style preferences. Therefore, this learning package is more than just workbooks; it is a complete program.

MODULE 1

PROBLEM SOLVING

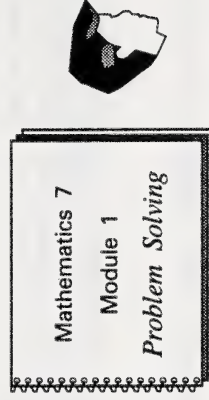
MODULE INTRODUCTION

What Lies Ahead

In the Module Introduction the student will learn what a "problem" is and that one of the main goals of this mathematics course is to improve the student's problem-solving skills.

Gathering Materials

For the Module Introduction the student will need the following item.



Put away the Assignment Booklet for Module 1 in a secure place until it is needed.

Tell the student where the video and computer disks are stored.

Guiding the Student

- Have the student read the Welcome and encourage the student to listen to the companion audiocassette.
- The teacher on the tape will help guide the student.
- Have the student preview the module booklet and read the Module Introduction.
- Next discuss the learning process, time management, and evaluation with the student. See the suggestions on the next page of this booklet.

The Learning Process

Each section of Module 1 deals with a different aspect of problem solving. Students will learn about this approach by reading notes in the module booklet or by viewing a video program. Afterwards the student will be given different problems to practice. Sometimes there is a computer alternative for students who have Apple or other compatible computers. When the student completes a practice exercise, you will help him or her check the answers and correct any errors. Emphasize to the student that the thinking process is more important than the answer. Encourage the student to explain how the answer was discovered.

Time Management

Decide how long the student will need to complete the module. An average student should spend about 2 weeks or 5 hours to complete the module. It is recommended that students spend no more than 1 hour at a time doing mathematics.

Evaluation

Explain that the grade on Module 1 is based on work in the Assignment Booklet. The module booklet will help prepare the student for the assignment booklet.

Additional Suggestions

The authors of this learning package recommend that you create a positive classroom atmosphere that allows students to express their own ideas and use individual approaches in problem solving. In order to develop this atmosphere you should do the following.

- Be supportive and encourage risk taking in finding solutions.
- Encourage students to use creative approaches.
- Be willing to accept unconventional solutions, more than one solution, or no solution (where appropriate).
- Challenge students to think critically and justify strategies and solutions.
- Be enthusiastic and capable of recognizing the students' willingness and perseverance to solve problems.¹

¹Alberta Education for the excerpt from the *Teachers Resource Manual for Junior High Mathematics*.

The authors of this learning package further recommend that group work be used in problem solving. "A student in a group deals with ideas and questions from other members of the group and this may help each student progress in developing problem-solving strategies."¹

The authors of this courseware also encourage the use of calculators in problem solving. "...time spent on tedious calculations is decreased and feedback on strategies is faster. Numbers from realistic and relevant situations are less imposing if calculators are used."¹

In order to help students improve their problem-solving skills, it is also recommended that you observe and question students while they are solving problems.

Below are some of the factors you should consider:

- willingness to attempt problems
- use of a systematic approach
- selection of appropriate strategies
- efficiency in selection of appropriate strategies
- logical justification of strategies and solutions
- perseverance
- growth of confidence in problem-solving ability
- transfer of problem-solving skills to situations other than mathematics¹

Note

Evaluation techniques and instruments for problem solving are suggested in *Problem Solving Challenge for Mathematics* (Alberta Education, 1985) pp. 7, 8, 52-56.

After your students have been introduced to problem solving in Module 1, they will be given further problem-solving opportunities in other modules.

You may also wish to supplement the problems in the learning package with those from other books. (For example, many teachers like to have a problem of the week.)

¹Alberta Education for the excerpts from the *Teachers Resource Manual for Junior High Mathematics*.



THE FOUR-STAGE PROCESS

What Lies Ahead


In this section the student will learn the four stages of problem solving.

- understanding the problem
- developing a plan
- trying the plan
- looking back


Gathering Materials

The student will need these items for this section:

Mathematics 7
Module 1
Problem Solving


(optional)

*THINKABOUT:
Find Your Guide
(AIT)*


1 or 2 loonies (\$1 coins)
1 metric ruler
4 cubes (sugar cubes, wooden cubes, or cardboard cubes)

Guiding the Student

- Have the student turn to Section 1 in the Module Booklet, and read the "What Lies Ahead" box and the introductory paragraphs of "Working Together."
- Next, have the student view the video or read the notes.
- Then have the student do the Practice Activities.
- Afterwards help the student check the answers and correct any errors. Suggested answers are on the next page of this booklet.

Practice Activities

1. Name the four stages in the process of problem solving.

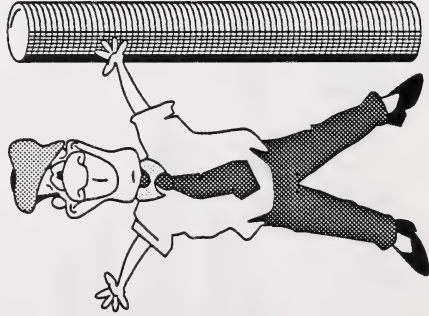
Suggested Answers

1. These are the four stages of problem solving.

- understanding the problem
- developing a plan
- trying the plan
- looking back

2. Tell how you would solve these problems.

- a. What is the worth of your height in loonies?



2. a. Measure your height in centimetres.

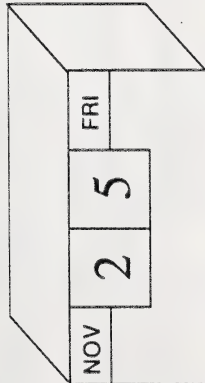
Determine the number of loonies required to make a pile one centimetre thick.

Multiply your height by the number of loonies required in the pile.

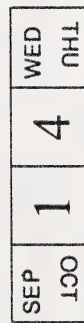
Example

If your height is 150 cm and the number of loonies required to measure one centimetre is 5, your height in loonies is $150 \times 5 = 750$ loonies.

- b. A calendar has four cubes that can be moved to show the date. The diagram below shows three views of the calendar: angle view (lid closed), top view (lid removed), angle view (lid removed). From the diagram you can only see parts of the four cubes. What numbers and words must there be on the six faces of each of the four cubes in the calendar in order to show all the dates in a year?

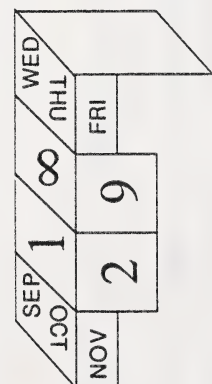


Angle View (Lid Closed)



Top View (Lid Removed)

9 is a 6 when you turn the cube upside down.



Angle View (Lid Removed)

- b. For this problem the student may use four cubes. Use one cube to write the months of the year. Write two consecutive months on each side of the cube.
- Use the second and third cube to write the dates of the month (01 to 31). To get the dates $11 \div 22$ both cubes must have 1 and 2. To get the dates 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 20, 30 both cubes must have 0. Therefore, write 0, 1, 2, 3, 4, 5 on one cube. Write 0, 1, 2, 8, 7, and 6 or 9 on the other cube.
- Use the fourth cube to write the days of the week. Write two consecutive days on each side of the cube. Two faces will be blank and one face will only have one day on it.

3. Jackie had this problem to solve.

Margot saved \$4 per week for 4 years. She did not keep her money in the bank. How much did she have at the end of the 4 years?

Jackie decided Margot had \$8320. Was her answer reasonable? Why or why not?

4. Frank had this problem to solve.

Which digit goes in the and which digit goes in the ?

$$\begin{array}{r} \square \square \\ + \square \square \\ \hline \square \square \end{array}$$

Frank solved the problem this way.

$$\begin{array}{r} \boxed{1} \boxed{1} \\ + \boxed{1} \boxed{1} \\ \hline \boxed{2} \boxed{2} \end{array}$$

Are there any other possible answers to the problem? If so, what are they?

3. You can tell if the answer is reasonable by comparing the answer to an estimate.

Example

The amount saved in 1 year is about $\$50 \times 4 = \200
The amount saved in 4 years is about $\$200 \times 4 = \800

No, \$8320 is not a reasonable answer.

4. Other Possible Answers

$$\begin{array}{r} 22 \\ + 22 \\ \hline 44 \end{array} \qquad \begin{array}{r} 33 \\ + 33 \\ \hline 66 \end{array} \qquad \begin{array}{r} 44 \\ + 44 \\ \hline 88 \end{array}$$

IDENTIFYING THE PROBLEM

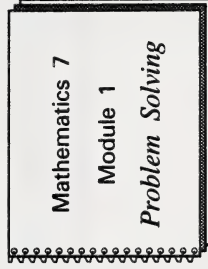
What Lies Ahead

In this section the student will learn these skills.

- identifying the essential elements of a problem namely what you know and what you need to know
- ignoring unnecessary details
- changing the setting of a problem to help understand the problem
- restating the problem in your own words

Gathering Materials

The student will need these items for this section:



MATHWORKS: Identifying the Problem
(AIT)

(optional)

Guiding the Student

- Have the student turn to Section 2 in the Module Booklet and read the "What Lies Ahead" box and the introductory paragraphs of "Working Together."
- Next, have the student view the video or read the notes.
- Then have the student do the Practice Activities.
- Afterwards help the student check the answers and correct any errors. Suggested answers are on the next page of this booklet.

Practice Activities

1. Cross out the unnecessary details in the following problems and restate the problems in your own words.

a. Olive and Mike picked out a digital watch with a timer and calendar for their father's birthday. His birthday is just 3 weeks away. Olive has \$8.36 and Mike has \$10.47. The watch, which normally costs \$35.00, is on sale. The sale price is \$25.00. Do Olive and Mike have enough money to buy the watch? If not, how much more do they need?

b. Marilyn works at Billy Bob's Burger Barn. She fries hamburgers and is in charge of the French fries. When she works on Monday, Wednesday, or Friday, she works for 6 hours a day. When she works on Tuesday or Thursday, she works for 4 hours a day. When she works on Saturday, she works for 8 hours a day. Last week she worked on Monday, Thursday, and Saturday. How many hours did she work?

Suggested Answers

1. a. Olive and Mike want to buy a watch for \$25.00. Olive has \$8.36 and Mike has \$10.47. How much more do they need?
- b. Marilyn worked 6 hours on Monday, 4 hours on Thursday, 8 hours on Saturday. How many hours did she work?

2. Change the setting in the following problems.

- a. A Portuguese man-of-war has tentacles 21.23 m long.

A sea wasp has tentacles 8.75 m long. How much longer are the Portuguese man-of-war's tentacles?

- b. One compact disk for a personal computer can store 200 000 pages of information. A library has 300 reference books. If each book has about 400 pages, how many compact disks will be needed to store all the information in the reference books?



2. Answers will vary.

Examples

- a. A building is 21.23 m high. A second building is 8.75 m high. How much higher is the first building?
- b. A truck can carry 200 000 pencils. A factory has 300 boxes of pencils. If each box has about 400 pencils, how many trucks will be needed to carry all the pencils?



REASONABLENESS OF ANSWERS

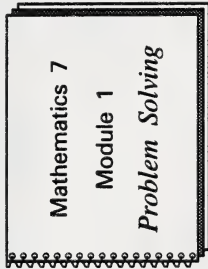
What Lies Ahead

In this section the student will learn these skills.

- estimating an answer
- determining if an answer is reasonable

Gathering Materials

The student will need these items for this section.



SOLVE IT: Reasonableness of Answers
(AIT)

(optional)

Guiding the Student

- Have the student turn to Section 3 in the Module Booklet, and read the "What Lies Ahead" box and the introductory paragraphs of "Working Together."
- Next, have the student view the video or read the notes.
- Then have the student do the Practice Activities.
- Afterwards help the student check the answers and correct any errors. Suggested answers are on the next page of this booklet.

Practice Activities

In Questions 1-3, estimate the answer. Then tell which answer is reasonable and explain why.

1. If a person walks 1 km, how many steps are taken?
Hint: 1 km = 1 000 m

- a. 25
- b. 100
- c. 2000

2. A hamburger patty has a mass of about 100 g. How much ground beef is needed for 25 people, eating 2 hamburgers each? Hint: 1 kg = 1 000 g

- a. 5 kg
- b. 50 kg
- c. 500 kg

3. You brush your teeth 3 times a day. If you use 2 mL of toothpaste each time you brush, about how many weeks will it take you to use up a 100 mL tube of toothpaste?

- a. 2 weeks
- b. 6 weeks
- c. 12 weeks

Suggested Answers

1. If you assume the person will make 2 steps to walk a 1-m distance, then 2 000 steps will be required to cover 1 000 m which is equivalent to 1 km.

c is the answer.

2. If 25 people could consume 50 patties, and each patty weighs 100 g, the total consumed will be 5 000 g which is equal to 5 kg.

a is the answer.

3. I need 6 mL of toothpaste a day or 42 mL a week. So the 100 mL, I have, will last for about 2 weeks.

a is the answer.

In Questions 4-6, calculate the answers. Then tell which answer is reasonable and why.

4. The 29 students in the seventh-grade class at the Willow Creek School are going on a field trip. Parents will drive them. Four students will fit in each car. How many cars will be needed?

- a. 7
- b. 1
- c. 7.25
- d. 8

5. Charlie's jazz band rehearsed a total of 29 hours in the last 4 days before the concert began. If they spaced their rehearsals equally over the 4 days, how many hours did they practise each day?

- a. 7
- b. 1
- c. 7.25
- d. 8

6. Annette has collected 29 cassette tapes. She wants to arrange them in a box which will hold 4 tapes in each row. How many tapes will she put in the last row?

- a. 7
- b. 1
- c. 7.25
- d. 8

4. **d** is the answer.

$$29 \div 4 = 7 \text{ R}1$$

Using 7 cars will cause one student to be left behind. Since all of the 29 must go, 8 cars are needed.

5. The answer is **c**.

$$29 \div 4 = 7.25$$

An exact answer is needed here. Fractions of an hour are possible.

6. The answer is **b**.

$$29 \div 7 = 4 \text{ R}1$$

Only 1 tape is in the last row since 28 tapes are required to complete 7 rows.

In Questions 7 and 8, draw a picture to help you get a reasonable answer.

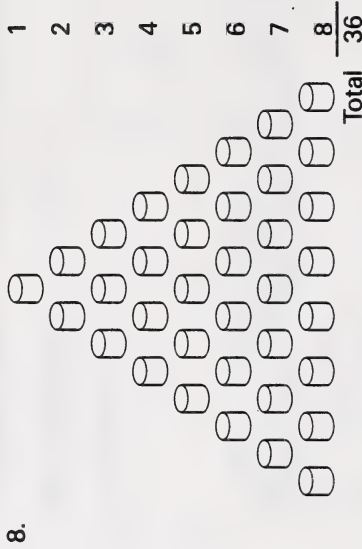
7. Nadine is building a dog run. She wants the run to be a square with 6 upright posts on each side. How many posts will she need?



- 7.
- ○ ○ ○ ○ ○
- ○ ○ ○ ○ ○
- ○ ○ ○ ○ ○
- ○ ○ ○ ○ ○
- ○ ○ ○ ○ ○
- ○ ○ ○ ○ ○

$$\text{Number of posts needed} = 6 + 4 + 6 + 4 + 6 + 4 = 20$$

8. Kris is stacking cans for a display in the grocery store window. She wants to make the stack look like a pyramid. She plans to start with a row of cans at the bottom, and put one less can in each row as she goes up, ending with one can at the very top. If she has 36 cans to stack in the display, how many should Kris begin with on the bottom row?



Kris should begin with 8 cans on the bottom row.

USING OBJECTS AND SKETCHES

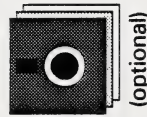
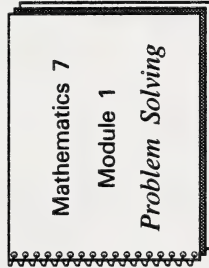
What Lies Ahead

In this section the student will learn these skills.

- using objects to solve problems
- drawing sketches to solve problems

Gathering Materials

The student will need these items for this section.



MATH STRATEGIES:
Solving Problems
(SRA) Disk 1



5 jars
pennies
toothpicks

Guiding the Student

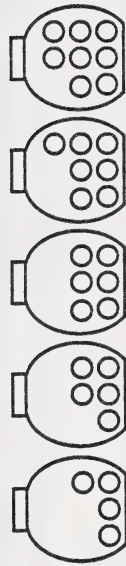
- Have the student turn to Section 4 in the Module Booklet, and read the "What Lies Ahead" box and the introductory paragraphs of "Working Together."
- Next, have the student view the video or read the notes.
- Then have the student do the Practice Activities.
- Afterwards help the student check the answers and correct any errors. Suggested answers are on the next page of this booklet.

Practice Activities

1. Use objects to help you solve the following problems.

- a. Five jars contain pennies. Each jar contains one penny more than the jar to its left. The last jar has twice as many pennies as the first. How many pennies are there in all?

1. a.



Total number of pennies: $4 + 5 + 6 + 7 + 8 = 30$

- b. In the sketch 12 toothpicks are arranged to make 4 squares. (5 actually, but do not count the big square.) How can you make 3 squares by repositioning 3 toothpicks?



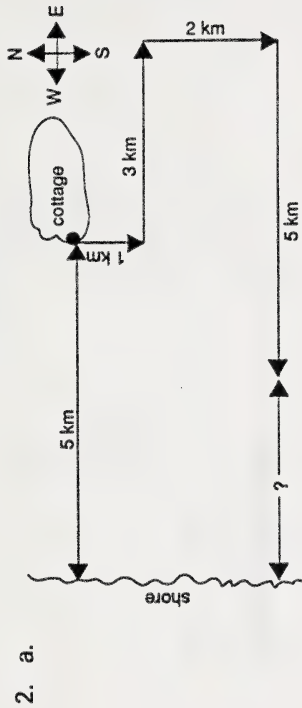
b.



Suggested Answers

2. Ken's cottage is on an island 5 km east of the shore of the lake. In his canoe he paddled 1 km south, 3 km east, 2 km south, and 5 km west. How far east is he from the shore of the lake?

a. Complete the sketch.



b. Solve the problem.

b. Ken is 3 km east from the shore of the lake.

Computer Alternative**3. Museum Trip****3. Computer-checked**

You'll need Disk 1 of *MATH STRATEGIES: Solving Problems* (SRA) to do this problem.

From the Chapter Menu, choose "5 Using Models." Then choose "1 Museum Trip."

After you've read the problem, decide how much help you want.

Follow the directions on the screen.

Note: Whenever a smiling face appears, the computer stops. To make it go on press RETURN.

4. Measuring Puzzle**4. Computer-checked**

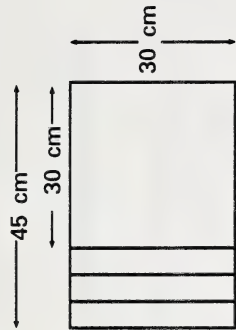
You'll need Disk 1 of *MATH STRATEGIES: Solving Problems* (SRA) to do this problem.

From the Chapter Menu, choose "5 Using Models." Then choose "Measuring Puzzle."

Complete as many Measuring Puzzles as you wish at the computer.

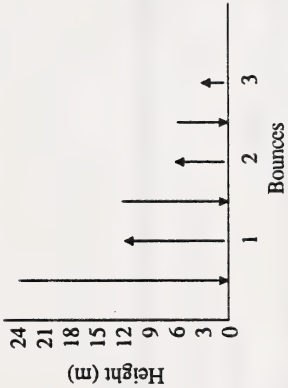
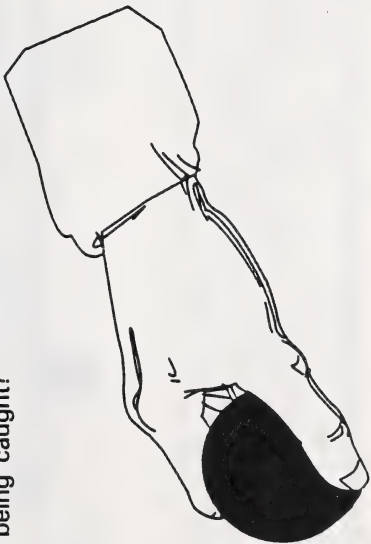
Print Alternatives

5. A pan of brownies is 45 cm by 30 cm. When 3 equal rows are cut from one end of the pan, the remaining part is a square. How wide is each row?



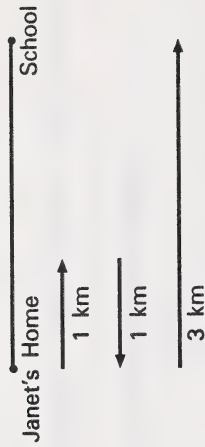
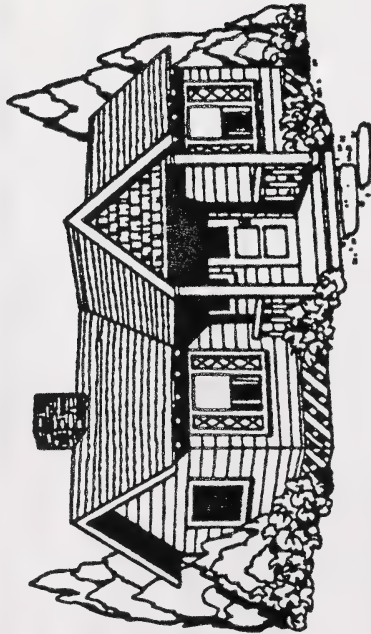
Calculate the total width cut.
 $45 - 30 = 15$
Calculate the width of each row.
 $15 \div 3 = 5$
Each row is 5 cm wide.

6. A ball is dropped from a height of 24 m. Each time it hits the ground it bounces to half the previous height. The ball is caught when its maximum height is 3 m. What is the total distance travelled during the bounces before being caught?



Calculate the total distance travelled.
 $24 + 12 + 12 + 6 + 6 + 3 + 3 = 63$
The ball travelled a total distance of 63 m before being caught.

7. Janet lives 3 km from school. One morning she walked 1 km before realizing that she had forgotten a library book. She returned home for the book and then went to school. How far did she walk to get to school that morning?



$$1 + 1 + 3 = 5$$

Janet walked 5 km to get to school on this particular day.

MAKING LISTS AND TABLES

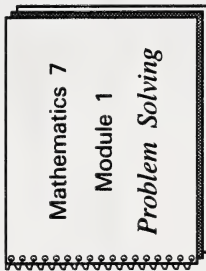
What Lies Ahead

In this section the student will learn these skills.

- making lists to solve problems
- making tables to solve problems

Gathering Materials

The student will need this item for this section.

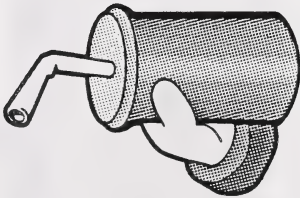


Guiding the Student

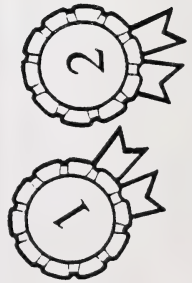
- Have the student turn to Section 5 of the Module Booklet, and read the "What Lies Ahead" box and the introductory paragraphs of "Working Together."
- Next, have the student view the video or read the notes.
- Then have the student do the Practice Activities.
- Afterwards help the student check the answers and correct any errors. Suggested answers are on the next page of this booklet.

Practice Activities

1. A can of pop costs \$0.80 in a vending machine. What coins can you use to buy one can? You can use quarters, nickels, and dimes. The machine does not give change.



2. At a track meet the children received 5 points for each first place ribbon and 3 points for each second place ribbon. Jason received 12 points. What ribbons did he win?



Suggested Answers

1. You can make a table to list the combinations.

Quarters	Dimes	Nickels
0	0	16
0	1	14
0	2	12
0	3	10
0	4	8
0	5	6
0	6	4
0	7	2
0	8	0
1	0	11
1	1	9
1	2	7
1	3	5
1	4	3
1	5	1
2	0	6
2	1	4
2	2	2
2	3	0
3	0	1

2. You can make a table to find the correct answers.

1st place ribbons	0	1	2	3
2nd place ribbons	4	3	1	0
Total points	12	14	13	15



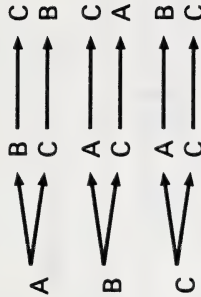
Jason won 4 second place ribbons.

3. Adam, Basma, and Calvin are standing in line to buy tickets for a concert. In how many different ways can they stand in line to buy their tickets?



4. Nadine has 3 different pairs of pants, 4 different shirts, and 2 different sweaters. How many different sweater-shirt-pants combinations can she choose from?

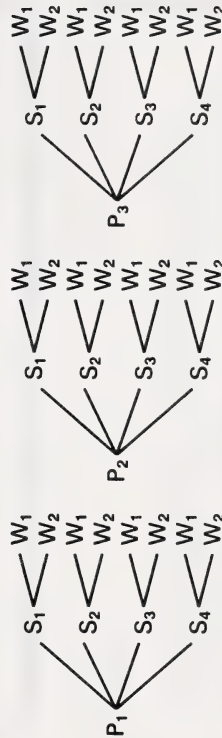
3. You can make a tree diagram. Let A represent Adam, B represent Basma, and C represent Calvin.



There are 6 different ways in which the ticket buyers can stand in line.

4. You can make a tree diagram.

Use P_1 , P_2 , P_3 to represent 3 different pairs of pants. Use S_1 , S_2 , S_3 , S_4 to represent 4 different pairs of shirts. Use W_1 , W_2 to represent 2 different sweaters.



There are 24 different sweater-shirt-pants combinations.



GUESSING-CHECKING-REVISING

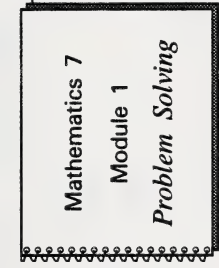
What Lies Ahead

In this section the student will learn these skills.

- solving problems by guessing, checking, and revising their answers
- organizing their guesses

Gathering Materials

The student will need these items for this section.



SOLVE IT:
Guess-Check-Revise
(AIT)

(optional)



Disk A of MAC 7:
"Guess and Test"
(Houghton Mifflin)

(optional)



Small squares of paper

Guiding the Student

- Have the student turn to Section 6 of the Module Booklet, and read the "What Lies Ahead" box and the introductory paragraphs of "Working Together."
- Next, have the student view the video or read the notes.
- Then have the student do the Practice Activities.
- Afterwards help the student check the answers and correct any errors. Suggested answers are on the next page of this booklet.

Suggested Answers

Practice Activities

Computer Alternative

1. Do the program "Guess and Test" on disk A of MAC 7 (Houghton-Mifflin).

1. Computer-checked

Print Alternative

2. Using each of the ten digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 only once, fill in the square to make this addition question true.

$$\begin{array}{r}
 \square \square \square \\
 + \square \square \square \\
 \hline
 \square \square \square
 \end{array}$$

2. To make it easier to guess and check you can write the numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 on small squares of paper. Notice it is easy to decide where to place the number 1.

$$\begin{array}{r}
 789 \\
 + 246 \\
 \hline
 1035
 \end{array}
 \quad \text{or} \quad
 \begin{array}{r}
 246 \\
 + 789 \\
 \hline
 1035
 \end{array}$$

3. In the subtraction problem below, each digit was replaced by a letter. Determine the original problem. (Note: If a letter is repeated, it means that the same digit is repeated in those places.)

$$\begin{array}{r}
 A B A \\
 - C A \\
 \hline
 A B
 \end{array}$$

3.
$$\begin{array}{r}
 101 \\
 - 91 \\
 \hline
 10
 \end{array}$$

4. A piece of fudge costs \$0.30, \$0.40, or \$0.60, depending on the type you buy. Yvonne bought the same number of \$0.40 fudge as \$0.60 fudge. If she paid \$6.90 for 15 pieces of fudge how many \$0.30 pieces of fudge did she buy?
4. A student may use as many guesses as required.
- Example

Guess	Number of \$0.40 fudge	Number of \$0.60 fudge	Number of \$0.30 fudge	Test
1	2	2	11	$2 \times \$0.40 = \0.80 $2 \times \$0.60 = \1.20 $11 \times \$0.30 = \3.30 <u>Total</u> <u>\$5.30</u>
2	3	3	9	$3 \times \$0.40 = \1.20 $3 \times \$0.60 = \1.80 $9 \times \$0.30 = \2.70 <u>Total</u> <u>\$5.70</u>
3	4	4	7	$4 \times \$0.40 = \1.60 $4 \times \$0.60 = \2.40 $7 \times \$0.30 = \2.10 <u>Total</u> <u>\$6.10</u>
4	5	5	5	$5 \times \$0.40 = \2.00 $5 \times \$0.60 = \3.00 $5 \times \$0.30 = \1.50 <u>Total</u> <u>\$6.50</u>
5	6	6	3	$6 \times \$0.40 = \2.40 $6 \times \$0.60 = \3.60 $3 \times \$0.30 = \0.90 <u>Total</u> <u>\$6.90</u>

5. Mai-Ling and Chris collect basketball cards. Mai-Ling has 23 more than Chris. Together they have 329. How many cards does Chris have?



5. A student may use as many guesses as required.

Guess	Chris	Mai-Ling	Test
1	200	$\begin{array}{r} 200 \\ + 23 \\ \hline 223 \end{array}$	$\begin{array}{r} 200 \text{ for Chris} \\ + 223 \text{ for Mai-Ling} \\ \hline 423 \text{ Total} \end{array}$
2	175	$\begin{array}{r} 175 \\ + 23 \\ \hline 198 \end{array}$	$\begin{array}{r} 175 \text{ for Chris} \\ + 198 \text{ for Mai-Ling} \\ \hline 373 \text{ Total} \end{array}$
3	150	$\begin{array}{r} 150 \\ + 23 \\ \hline 173 \end{array}$	$\begin{array}{r} 150 \text{ for Chris} \\ + 173 \text{ for Mai-Ling} \\ \hline 323 \text{ Total} \end{array}$
4	153	$\begin{array}{r} 153 \\ + 23 \\ \hline 176 \end{array}$	$\begin{array}{r} 153 \text{ for Chris} \\ + 176 \text{ for Mai-Ling} \\ \hline 329 \text{ Total} \end{array}$

FINDING AND APPLYING A PATTERN

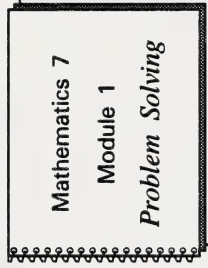
What Lies Ahead

In this section the student will learn these skills.

- making a simpler model of a complex problem in order to find a pattern
- applying the pattern to solve the problem

Gathering Materials

The student will need these items for this section.



THINKABOUT: Find Your Guide (AIT)



(optional)

SOLVE IT: Solving a Simpler Problem (AIT)



MATH STRATEGIES: Problem Solving (SRA) Disk 1



(optional)

Guiding the Student

- Have the student turn to Section 7 of the Module Booklet, and read the "What Lies Ahead" box and the introductory paragraphs of "Working Together."
- Next, have the student view the video or read the notes.
- Then have the student do the Practice Activities.
- Afterwards help the student check the answers and correct any errors. Suggested answers are on the next page of this booklet.

Practice Activities**Suggested Answers****Computer Alternative****1. Calculator Practice**

The computer program you will be using has a built-in calculator to help you do computations. So you should see how the calculator works.

1. Computer-checked

You will be working at the computer, so take this booklet and Disk 1 of the *MATH STRATEGIES: Problem Solving* (SRA) with you. Run the disk and wait until you see the Chapter Menu on the screen.

Type "1." Press *RETURN*. Follow the directions on the screen until you see this chart:

KEY:	
Plus	+
Minus	-
Times	x or *
Divided by	/
Is equal to	<i>RETURN</i>

Notice that you may type either **[X]** or **[*]** for multiplication. Also, since there is no **[÷]** key, use the **[/]** key for division **[/]** instead. (Note: You need to use the SHIFT key when typing **[+]** or **[*]**.)

Type $46 + 38$. Press *RETURN*. Here's what should be on the screen:

$$46 + 38 = 84$$

On the next line, you see a "." followed by a flashing "—" This is the signal that the calculator is ready for the next calculation.

Try holding the SHIFT key and pressing the **[=]** key. As you can see, the "=" sign is not used on this calculator. Whenever you're ready for the calculator to show the answer, press *RETURN* instead.

Type 876. Then press the **[←]** key once. Watch carefully to see what happens. The 6 is erased. When you want to erase something you have typed, use the **[←]** key. Note: Once you have pressed *RETURN*, you cannot erase.

To erase all the work that is on the screen, type E. Try it.

If you want to type a 5-digit number, say 34672, you will have to type 34672. The calculator will not accept spaces.

2. Computer-checked

2. Spy Ring

Choose "Program 5 Using Models" from disk 1 of the *MATH STRATEGIES: Solving Problems (SRA)* package. Then do the "Spy Ring Problem."

Note

When you see "._" on the screen, it means you can use the built-in calculator to do calculations. After you have done the calculations you must enter your answer and press *RETURN*.

Print Alternative

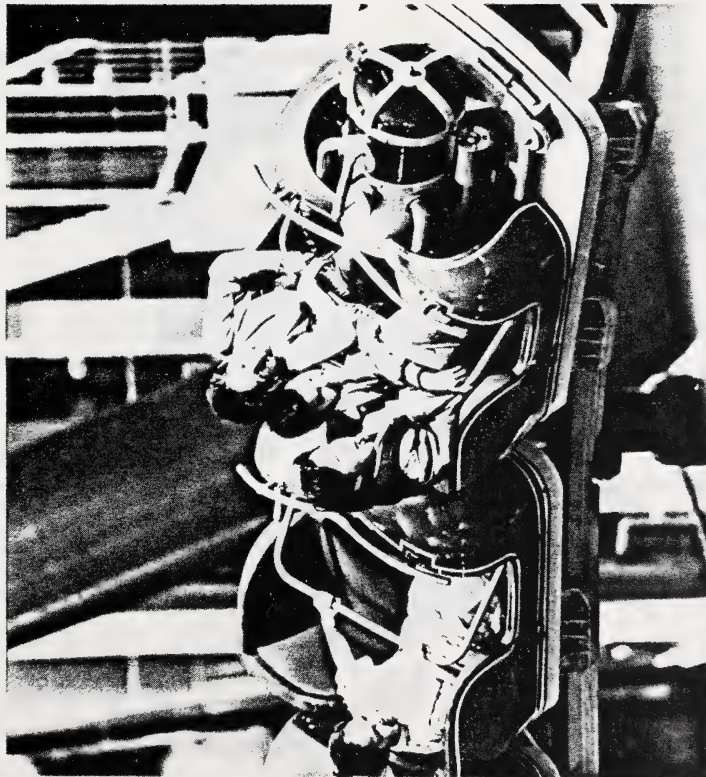
For these problems, you may act out the problem or draw diagrams in order to help you find the patterns. Apply these patterns to solve the problems.

3. Eight students are having a chess tournament. They decided that everyone would play everyone else one game of chess, and the person who won the most games would be the winner. How many games of chess they will play?

Student	Number of Games	Pattern
1	0	+1
2	1	+2
3	3	+3
4	8	+4
5	10	+5
6	15	+6
7	21	+7
8	28	

Eight students would play 28 games of chess.

4. Four adults and four children visited an amusement park and decided to ride on the roller-coaster ride. The rules required that each child be accompanied by an adult on the ride. How many different ways can the adults be paired with the children?



WESTFILE INC.

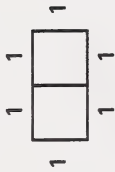
Adults	Children	Different Pairs	Pattern
1	1	1	1 × 1
2	1	2	2 × 1
3	1	3	3 × 1
4	1	4	4 × 1
1	2	2	1 × 2
2	2	4	2 × 2
3	2	6	3 × 2
4	2	8	4 × 2
1	3	3	1 × 3
2	3	6	2 × 3
3	3	9	3 × 3
4	3	12	4 × 3
4	4	16	4 × 4

There are 16 different ways 4 adults and 4 children can be paired.

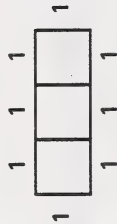
5. One person can be seated on each of the four sides of a square table. If the tables are arranged in one long row, how many square tables are needed to seat 40 people?



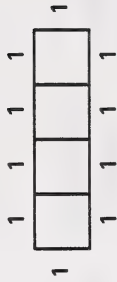
5. Two square tables will seat 6 people.



Three square tables will seat 8 people.



Four tables will seat 10 people.



Find the pattern.

Number of Tables	2	3	4
Number of People	6	8	10

+2 +2 ← Pattern

Apply the pattern.

Number of Tables	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Number of People	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40

+2 +2 +2

Nineteen square tables will seat 40 people.

SIMPLIFYING A PROBLEM

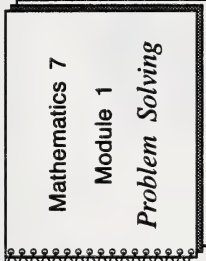
What Lies Ahead

In this section the student will learn these skills.

- using smaller numbers in a problem with big numbers
- breaking problems into steps

Gathering Materials

The student will need these items for this section.



SOLVE IT: Solving a Simpler Problem (AIT)



(optional)

MATH WORKS: Simplifying a Problem (AIT)



(optional)

MATH STRATEGIES: Problem Solving (SRA), Disk 1 and Disk 2

Guiding the Student

- Have the student turn to Section 8 of the Module Booklet, and read the "What Lies Ahead" box and the introductory paragraphs of "Working Together."
- Next, have the student view the video or read the notes.
- Then have the student do the Practice Activities.
- Afterwards help the student check the answers and correct any errors. Suggested answers are on the next page of this booklet.

Practice Activities

In Questions 1 and 2 use a simpler problem to help you decide what to do. You can change the settings and the numbers, but do not change the operations.

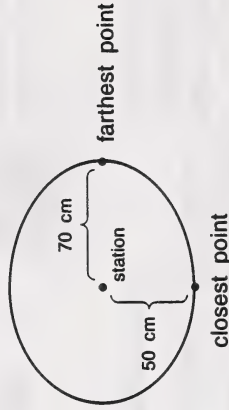
1. The planet Venus circles the sun in a highly elliptical or egg-shaped orbit, ranging between 109 000 000 km from the sun and about 107 000 000 km from the sun. About how much farther from the sun is Venus when it is at its farthest point, as compared to when it is at its closest point?

Suggested Answers

1. Models will vary.

Example

A toy train circles a railway station in an elliptical path. At its farthest point the train is 70 cm from the station. At its closest point the train is 50 cm from the station. How much farther from the station is the train when it is at its farthest point, compared to when it is at its closest point?



$$70 - 50 = 20$$

The train is 20 cm farther from the station.

From this simpler module you can see how to solve the original problem.

$$109\,000\,000 - 107\,000\,000 = 2\,000\,000$$

Venus is 2 000 000 km farther from the sun at the farthest point in its orbit as compared to its closest point in its orbit.

2. Distance in space is measured by light years. A light year is the distance that a beam of light travels in one year and is equivalent to 9 460 000 000 000 km. The Milky Way is estimated to be about 100 000 light years in diameter. What is the approximate diameter of the Milky Way in kilometres?

2. Models will vary.

Example

Distances can be measured by pacing. A pace is the distance you cover in one step and is about 0.5 m. My flower garden is about 6 paces in diameter. What is the diameter of my garden in metres?



$$6 \times 0.5 = 3$$

My flower garden is about 3 m in diameter.

From this simpler model, you can see how to solve the original problem.

$$100\,000 \times 9\,460\,000\,000\,000 = 946\,000\,000\,000\,000\,000$$

Computer Alternative

3. Do "Lightning Strikes" from *MATH STRATEGIES: Problem Solving* (SRA). 3. Computer-checked

You will need Disk 1. Start Disk 1. When the Chapter Menu comes on the screen, type "2" and press *RETURN*. You will then see the menu for Simplifying Problems.

Type "1" for "Lightning Strikes" and press *RETURN*.

Follow the instructions on the screen.

4. Do "A Beautiful Dream" from *MATH STRATEGIES: Problem Solving* (SRA). 4. Computer-checked

Use Disk 2. From the Chapter Menu, choose "3 Problem Breakdown." Then, choose "2 A Beautiful Dream."

Solve the problem at the computer.

Print Alternative

In Questions 5 and 6 simplify the problems by doing them in steps.

5. Paul has muscular dystrophy and he uses a wheelchair. His county is having a walkathon for muscular dystrophy. Paul will "walk" with his wheelchair. If Paul goes 10 km, how much will he earn for muscular dystrophy? See the list of Paul's sponsors at the right. It shows how much each person will donate for each kilometre Paul covers.



5.

Sponsors	Amount per km
John Sanderson	\$0.05
Gerry Van Buren	\$0.25
Sophie Tuckerson	\$1.00
Bill Erd	\$0.60
Leslie Schwartz	\$0.15
Sue Mullaby	\$0.03

Method 1

Find the total amount per km.

$$\$0.05 + \$0.25 + \$1.00 + \$0.60 + \$0.15 + \$0.03 = \$2.08$$

Then multiply by 10.

$$10 \times \$2.08 = \$20.80$$

Paul earns \$20.80 for muscular dystrophy.

Method 2:

You could also multiply each amount in the table by 10 and total them all.

$$\begin{array}{r}
 0.05 \times 10 = \$ 0.50 \\
 0.25 \times 10 = 2.50 \\
 1.00 \times 10 = 10.00 \\
 0.60 \times 10 = 6.00 \\
 0.15 \times 10 = 1.50 \\
 0.03 \times 10 = 0.30 \\
 \hline
 \$20.80
 \end{array}$$

Paul earns \$20.80 for muscular dystrophy.

6. A computer keyboard has a problem. It beeps whenever the 3 or the 8 key is typed. If you type the numbers from 100 to 199, how many times will the computer beep?

6.

Numbers	How many 3's	How many 8's
101 to 110	1	1
111 to 120	1	1
121 to 130	2	1
131 to 140	9	1
141 to 150	1	1
151 to 160	1	1
161 to 170	1	1
171 to 180	1	2
181 to 190	1	9
191 to 199	1	1
Total	19	19

The computer will beep 38 times.

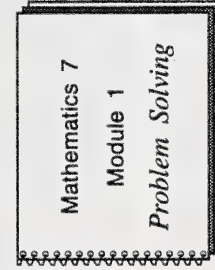
MORE THAN ONE WAY TO GO

What Lies Ahead

In this section the student will learn that there are many ways to solve one problem.

Gathering Materials

The student will need these items for this section.



(optional)

THINKABOUT:

There are Many Ways to Go (AIT)



(optional)

Problem Solving Strategies (MECC)



Guiding the Student

- Have the student turn to Section 9 in the Module Booklet, and read the "What Lies Ahead" box and the introductory paragraphs of "Working Together."
- Next, have the student view the video or read the notes.
- Then have the student do the Practice Activities.
- Afterwards help the student check the answers and correct any errors. Suggested answers are on the next page of this booklet.

Practice Activities**Computer Alternative**

1. Do programs “diagonals” and “squares” in *Problem Solving Strategies*. (MECC).

Suggested Answers

1. Computer-checked

Print Alternative

In Questions 2 and 3 use two different methods to solve the problems.

2. How many rectangles are in this figure?

2. One method is to make an organized list of the rectangles.

1	4	7	10
2	5	8	11
3	6	9	12

13	14	15	16

17	18	19	20

21	22	23	24
----	----	----	----

continued

25	28
26	29
27	30

49		

31	
32	
33	

40	41

34	35

	51	

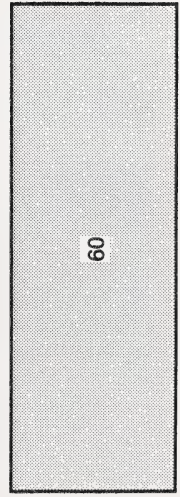
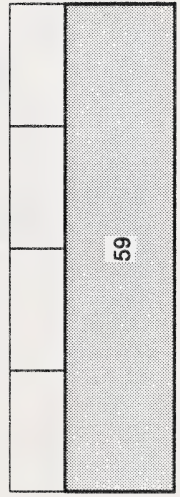
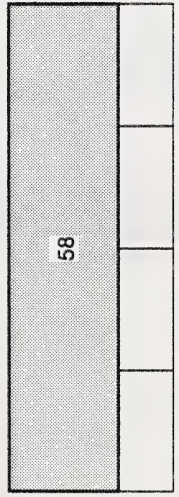
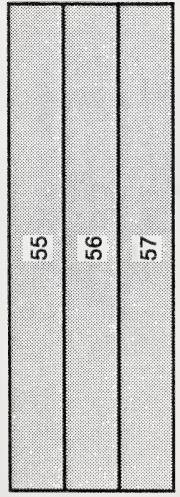
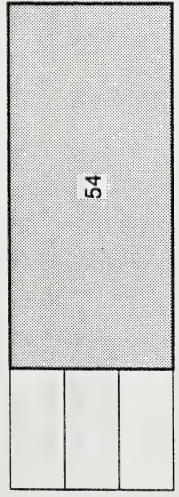
36	37	

43		
44		
45		

38		

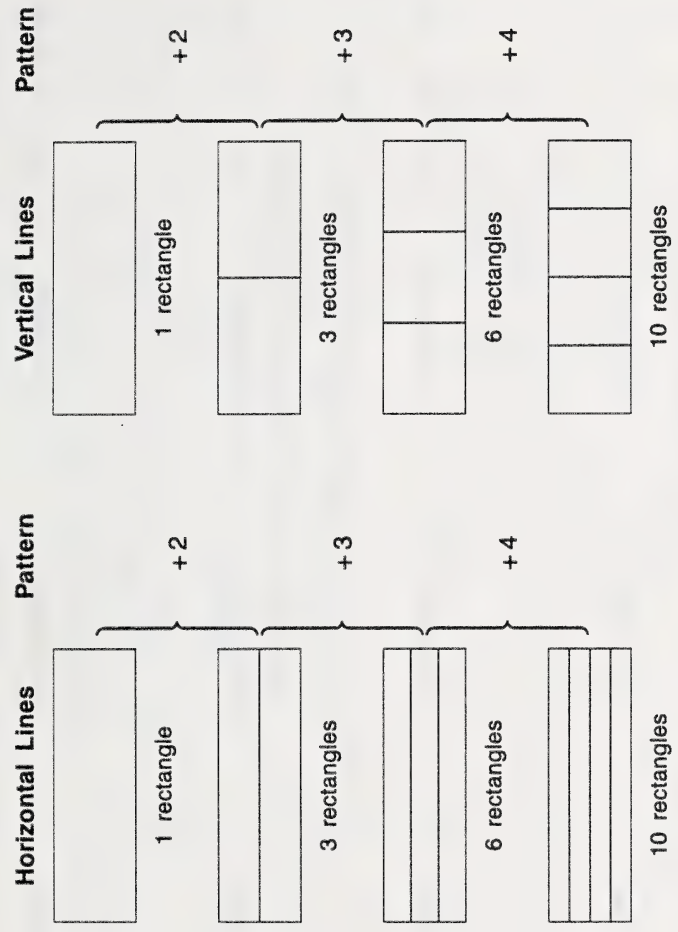
46		
47		
48		

53		


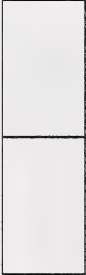




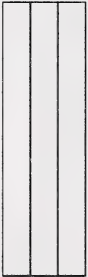


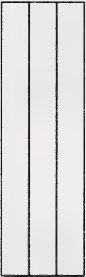




There are 60 rectangles altogether.

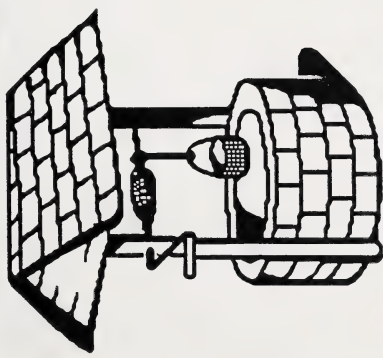
Another way to do 2.a. is to find a pattern. There is a pattern when lines are added to the original rectangle either horizontally or vertically.



Note there is a different pattern when lines are added in both directions.

Horizontal Lines	Vertical Lines	Lines in Both Directions	Pattern
			$3 \times 3 = 9$
			$6 \times 3 = 18$
			$6 \times 6 = 36$
			$6 \times 10 = 60$

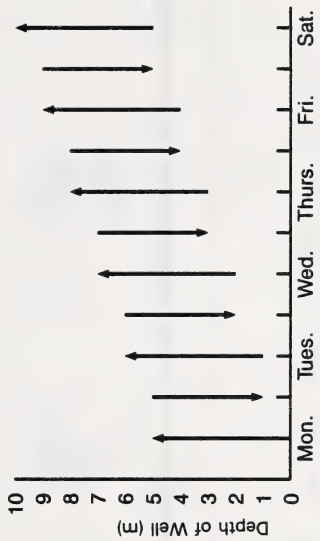
3. A well is 10 m deep. A salamander climbs up 5 m during the day and climbs down 4 m at night. If the salamander started at the bottom on Monday, on what day will it get to the top?



	Day	Night
Monday	5 m	5 - 4 = 1 m
Tuesday	5 + 1 = 6 m	6 - 4 = 2 m
Wednesday	5 + 2 = 7 m	7 - 4 = 3 m
Thursday	5 + 3 = 8 m	8 - 4 = 4 m
Friday	5 + 4 = 9 m	9 - 4 = 5 m
Saturday	5 + 5 = 10 m reaches the top	

The salamander will reach the top on Saturday.

Another way to solve the problem is to make a diagram.



The salamander will get to the top on Saturday.



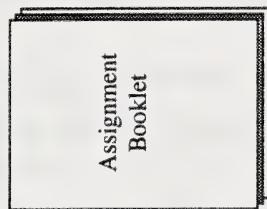
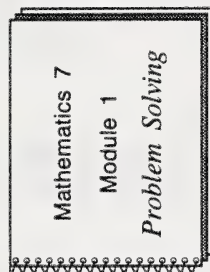
MODULE CONCLUSION

What Lies Ahead

The student is now ready to do the assignment in the Assignment Booklet. The student will be graded on the work done in this booklet.

Gathering Materials

The student will need the following items.



Guiding the Student

- Have the student complete the Assignment Booklet. The student may refer to the notes, but the assignments must be done independently.
- Afterwards, give the student feedback and a grade. Suggested answers are provided on the next few pages of this booklet.

Suggested Answers to Assignment Booklet

20

Part 1: Multiple-Choice Questions

Each of the following questions has four suggested answers, one of which is better than the others. Place the letter of the best answer in the blank on the response page.

1. Amber is two years older than Shawna and Shawna is one year older than Andrea. Which question can you answer using this information?
 - a. How old is Amber?
 - b. How old is Shawna?
 - c. How much older is Shawna than Amber?
 - d. How much older is Amber than Andrea?

2. One serving of ice cream has a mass of about 150 g. How much ice cream is needed to serve 20 students? Be sure to choose the most reasonable answer.
 - a. 30 g
 - b. 300 g
 - c. 3 000 g
 - d. 30 000 g

3. Which statement is **not** one of the techniques used to identify the necessary parts of a problem?
 - a. Guess-check-revise
 - b. Eliminate unnecessary information.
 - c. Change the setting of the problem.
 - d. Restate the problem.

4. Karen worked a total of 31 hours at a store during a 4-day sale. She worked an equal amount of time on each of the four days. How long did she work each day? Be sure to choose the most reasonable answer.
 - a. 3 h
 - b. 7 h
 - c. 8 h
 - d. 7.75 h

Part 1 Response Page1. d 2. c 3. a 4. d

Part 1 (continued)

5. On a field trip 31 students are driven in cars. If four students can go in each car, how many cars are needed? Be sure to choose the most reasonable answer.
- a. 3 cars
 - b. 7 cars
 - c. 8 cars
 - d. 7.75 cars

6. Consider the following problem.

Problem: Twenty-four posts are used to enclose a square pen. The posts are placed 3 m apart. What is the length of one side of the pen?

Which one of the following strategies would you use to solve the above problem?

- a. Make an organized list.
 - b. Make a sketch.
 - c. Find and apply a pattern.
 - d. Simplify the problem.
7. The four stages used to solve a problem have been given simple names. Which simple name describes the stage called “trying the plan”?
- a. See
 - b. So
 - c. Hey Wait
 - d. Think
8. In which stage of the four-stage process for problem solving should you consider the strategies that may be used to solve the problem?
- a. Developing a plan
 - b. Looking back
 - c. Trying the plan
 - d. Understanding the problem

Part 1 Response Page (continued)5. c 6. b 7. a 8. a

Part 1 (continued)

9. Consider the following problem.

Problem: A, B, and C are waiting in a line-up to buy tickets for a hockey game. In how many different ways can they stand in line?

Which of the organized lists below would provide the answer to the above problem?

- a. A-A-B A-B-A B-B-A B-B-C C-C-A C-C-B
- b. A-B-C B-C-A C-A-B
- c. A-B-C-D B-C-A-D C-A-B-D D-A-B-C
- d. A-B-C A-C-B B-A-C B-C-A C-A-B C-B-A

10. Consider the following problem.

Problem: There are a total of 15 animals in the barn. Some are chickens and some are kittens. If there are 42 legs in all, how many kittens are there?

The above problem can be solved by using either of two strategies. What strategies would work?

- a. Making a sketch OR Simplifying the problem
- b. Simplifying the problem OR Finding and applying a pattern
- c. Finding a pattern OR Making a table
- d. Making a table OR Guessing-checking-revising

Part 1 Response Page (continued)9. d 10. c **Total for Part 1 = _____ (maximum possible: 20 marks)**

30

Part 2: Short-Answer Questions

Give the complete answers in the spaces provided on the response page.

- 4
1. List the four stages that are used to solve any problem.
- 4
2. In your own words explain how to solve the problem below.
- Problem: What is the total value of the 25-cent coins in a stack as high as the edge of a desk?
- 4
3. Five friends, A, B, C, D, and E always exchange greeting cards at holiday time. Make an organized list showing all the possible cards that would be sent each year. The list has been started for you.

Part 2 Response Page

1. a. Understanding the problem
b. Developing a plan
c. Trying the plan
d. Looking back
2. Measure the height of the desk in cm. Find the number of quarters required for a 1-cm stack. Multiply this number by \$0.25. Then multiply the height of the desk by the value of a 1-cm stack of quarters.
3. A - B B - A C - A D - A E - A
A - C B - C C - B D - B E - B
A - D B - D C - D D - C E - C
A - E B - E C - E D - E E - D

Part 2 (continued)**3**

4. Change the setting of the problem below to something familiar to you. You can do this by changing numbers and details, but do not change the required mathematical operations.

Problem: The total Canadian national debt in 1940 was \$3 271 300 000. In 1987 the national debt was \$264 101 000 000. During this time by how much did Canada's national debt increase?

3

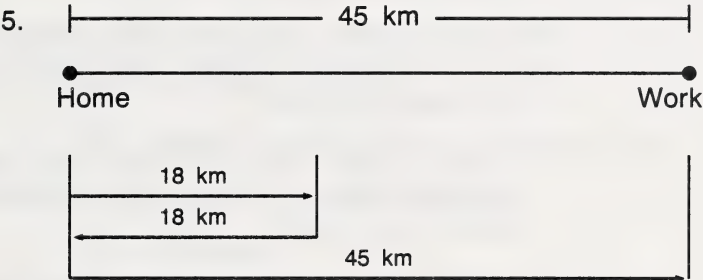
5. Make a sketch that can be used to solve the following problem.

Problem: Brian lives 45 km from work. One morning he drove 18 km before realizing that he had forgotten his lunch. He returned home for his lunch and then went to work. How far did he drive to get to work that morning?

Part 2 Response Page (continued)

4. Answer will vary. Example

In 1980, my father had a debt of \$3500. In 1985, his debt was \$4200. During this time, by how much has my father's debt increased?



Part 2 (continued)

4

6. You have learned several strategies that can be used for solving problems. Some of these are listed below.

- Using objects
- Drawing a sketch
- Making a table
- Simplifying the problem
- Finding and applying a pattern
- Making an organized list
- Guessing-checking-revising

For each problem given, select the strategy that will be the most useful for solving that problem and write the name of the strategy on the response page.

- a. Twenty people came to a party and were introduced. How many handshakes would have been made if two people shake hands each time?
- b. Junior earns 25 cents each time he does the dishes and 10 cents each time he sweeps the floor. At the end of the week he has done 9 jobs and earned \$1.65. How many times did he sweep the floor?
- c. The distance from Edmonton to Wild Horse in the south is 671 km. From Edmonton to Indian Cabins in the north is 915 km. What is the distance from Wild Horse to Indian Cabins?
- d. Betty must measure exactly 6 litres of water with only a 9-litre pail and a 4-litre pail. Explain how she can measure 6 litres in the fewest steps.

4

7. Consider the following problem.

Problem: Anita spends three times as much time watching TV as she does reading. She watched TV for 15 hours one weekend. How many books did she read that weekend?

- a. There is not enough information to solve this problem. Supply the missing information.
- b. Solve the problem using this added information.

Part 2 Response Page (continued)

6. a. Finding and applying a pattern

b. Making a table

c. Simplifying the problem

d. Drawing a sketch or using objects

7. Answers will vary. Example

a. On average it takes 2 hours for Anita to read a book.

b. Calculate the time spent reading

$$\frac{15}{3} = 5 \text{ hours}$$

Calculate the number of books read

$$\frac{5}{2} = 2.5$$

Anita read 2.5 books that weekend.

Part 2 (continued)**4**

8. In the problem on the response page, underline the essential information only. Then, using the underlined parts, restate the problem in your own words on the response page.

Part 2 Response Page (continued)

Problem: Mr. Robinson has \$1 303.64 in his bank account. He wants to buy a birthday present for his 13-year-old daughter. After shopping around for several days, he decides to get her a jewelry box valued at \$129.95. This is a sale price and appears to be a good value. He buys the gift by writing a cheque. What is the new balance in his bank account after making his purchase?

8. Mr. Robinson has \$1 303.64 in his bank account. He withdraws \$129.95 to buy a gift. What is his new balance?

Total for Part 2 = _____ (maximum possible: 30 marks)

30

Part 3: Problems

Choose any **five** of the following seven problems. Answer the questions asked in a sentence. Be sure to show clearly how you arrived at your answer. Place your answers and your work on the appropriate response pages.

1. The planet Pluto is 4 423 200 000 km from the Sun at its nearest point. At its farthest point Neptune is 4 539 800 000 km from the Sun. When their orbits come together, how much closer to the Sun is Pluto than Neptune?
2. A bag contains two red chips and three black chips. How many different ways are there of removing the chips one at a time?

Part 3 Response Page

1. Pluto is 116 600 000 km closer to the sun than Neptune when their orbits come together.

Note: Students should answer the question asked in a sentence and they should explain how they arrived at this answer.

It is recommended that you score 2 marks for understanding the problem, 2 marks for developing and carrying out the plan, and 2 marks for looking back.

2. There are 10 ways of removing the chips.

Note: Students should answer the question asked in a sentence and they should explain how they arrived at this answer.

It is recommended that you score 2 marks for understanding the problem, 2 marks for developing and carrying out the plan, and 2 marks for looking back.

Part 3 (continued)

3. A certain computer “beeps” whenever the 4 key is typed. If Jasmine types all the numbers from 34 to 84, how many times will the computer “beep”?
4. Farmer John wants to build a corral using 9 posts on each of the longer sides and 4 posts on each of the shorter sides. How many posts does he need?

Part 3 Response Page (continued)

3. The computer will beep 16 times.

Note: Students should answer the question asked in a sentence and they should explain how they arrived at this answer.

It is recommended that you score 2 marks for understanding the problem, 2 marks for developing and carrying out the plan, and 2 marks for looking back.

4. Farmer John needs 22 posts.

Note: Students should answer the question asked in a sentence and they should explain how they arrived at this answer.

It is recommended that you score 2 marks for understanding the problem, 2 marks for developing and carrying out the plan, and 2 marks for looking back.

Part 3 (continued)

5. In each round of a tennis tournament, the players are grouped into pairs for a match with only the winner advancing to the next round. If 16 players start in the tournament, how many matches must be played before a single winner can be declared?
6. The Moars parked their car in a parking lot while they went shopping. How much did they pay if they parked from 10:15 a.m. until 2:45 p.m.?

Park — Your — Car	
First Hour	\$0.75
Each additional hour or part of an hour	\$0.25
Maximum	\$3.00

7. The gym is open Monday through Saturday. Volleyball classes meet daily except Wednesday. Tennis is daily except Tuesdays and Saturdays. Daily classes are offered in table tennis. Swimming classes are held every other day starting on Mondays. Gymnastics instruction is available daily except Monday. What is the busiest day at the gym?

Part 3 Response Page (continued)

5. Before a simple winner can be declared, 15 matches must be played.

Note: Students should answer the question asked in a sentence and they should explain how they arrived at this answer.

It is recommended that you score 2 marks for understanding the problem, 2 marks for developing and carrying out the plan and 2 marks for looking back.

6. While shopping the Moars paid 1.75 for parking their car in a parking lot.

Note: Students should answer the question asked in a sentence and they should explain how they arrived at this answer.

It is recommended that you score 2 marks for understanding the problem, 2 marks for developing and carrying out the plan and 2 marks for looking back.

7. The busiest day at the gym is Friday.

Note: Students should answer the question asked in a sentence and they should explain how they arrived at this answer.

It is recommended that you score 2 marks for understanding the problem, 2 marks for developing and carrying out the plan and 2 marks for looking back.

Total for Part 3 = _____ (maximum possible: 30 marks)



Mathematics 7

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